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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the method of recording information to an optical recording medium and an optical recording medium.
[0002]
[Description of the Prior Art]In recent years, increase of the amount of information recordable on the optical recording medium of one sheet, soft circulation of the information recorded on the optical recording medium, and illegal-copy-prevention art progress, and it is requested that each identification information is recorded to an optical recording medium as what is called security art.
[0003]As identification information to an optical recording medium, to this request, For example, the postscript region which carried out overwrite of the bar code to the pit section of the only for [reproduction] type optical recording medium () [Burst CuttingArea and] the following "BCA" -- saying -- it provides and is generally applied to the art which records an encryption key and a decode key on a BCA field [for every optical recording medium / the different identification information (ID) and if needed] at the time of optical-recording-medium manufacture.
[0004]As one example which records a signal on the BCA field of the optical recording medium only for this reproduction, there is a method as shown in drawing 14. That is, by setting laser by the pattern shape of BCA and irradiating with it in pulse based on the modulating signal modulated according to specific identification information, such as ID, as shown in drawing 14 (1), as shown in drawing 14 (2), package destructive removal of the reflection film of an optical recording medium is carried out at stripe shape. As a reflection film shows drawing 14 (3) in the portion by which destructive removal was carried out, and the left-behind portion, BCA of stripe shape is formed on an optical recording medium. If the BCA pattern of this stripe shape

is reproduced by the optical head of an optical information recording and reproducing device, since the reflection film has disappeared, as shown in drawing 14 (4), in the BCA section, a modulating signal will serve as an intermittently missing waveform. By applying filtering for this wave-like missing part, as shown in drawing 14 (5), and detecting digital regenerative data for the business of drawing 14 (6), the identification information currently recorded on the optical recording medium can be obtained. By reading this identification information, it becomes possible to specify optical-recording-medium each.

[0005]The recorded type optical information recording medium provided with the information layer which can record an information signal on the other hand, or the rewritten type optical information recording medium provided with the information layer which can rewrite an information signal freely is also developed, and diversity is increased. In this recorded type optical information recording medium and a rewritten type optical information recording medium (henceforth an "optical disc" also including a recorded type and a rewritten type), since information can record freely, importance is increasingly attached to the handling to the security to the information recorded on the optical disc.

[0006]

[Problem(s) to be Solved by the Invention]However, if it is going to apply the BCA pattern formation method which carries out destructive removal of the reflecting layer in an only for [playback] type optical recording medium to an optical disc, SUBJECT as shown below will occur.

[0007]First, since the existence of information is detected by the optical change of the information layer itself, even if it is the composition of the optical disc temporarily provided with the reflecting layer, an optical difference is hardly undetectable [with the BCA pattern which vanished only the reflecting layer] in the information layer containing which photoactive material of coloring matter, a magnetic material, or a phase change type recording material. Therefore, it is necessary to occur change which can detect optically the information layer itself which can record an information signal on an optical disc.

[0008]Next, even if it is going to adopt the method of imitating the BCA pattern formation method in an only for [playback] type optical recording medium, irradiating with the laser set by BCA pattern shape in pulse, and carrying out destructive removal of the information layer of an optical disc, Since cascade screens, such as an enhanced layer, a hard layer, an interlayer, and a dielectric layer, are formed in the one side side of an information layer at least, Destructive removal only of the information layer containing optical activity material cannot be carried out selectively, The droplet of an information layer and/or a cascade screen occurs the information layer near the boundary part of a BCA pattern and/or exfoliation of a cascade screen, and inside a BCA pattern, distortion arises in formation of a BCA pattern part, and SUBJECT from which a noise mixes in the signal which detects BCA, and sufficient BCA

signal is not acquired occurs.

[0009]The defect resulting from the information layer near the BCA pattern and/or exfoliation of a cascade screen does not stop at a sub information domain, but fatal SUBJECT generates it for the information layer and/or cascade screen of a main information region, and a recorded type optical recording medium.

[0010]In particular, at the phase-change optical disk, information is recorded by irradiating an information layer with the optical beam which carried out pulse modulation according to the information signal, making it cool, after carrying out melting of the information layer, and forming a recording mark. Since melting follows on an information layer, for thus, the purpose of controlling the phenomenon which causes change to a recording characteristic when the optical activity material of the information layer of a molten state pulsates or flows. The composition provided with the material which is excellent in the heat machine characteristic, and which is generally called a dielectric in contact with an information layer rather than the material which constitutes an information layer is adopted. In the rewritten type optical disc from which a phase state changes reversibly, the composition which pinches an information layer with a dielectric is taken.

[0011]The cascade screen which has the operation which controls phenomena, such as pulsation at the time of melting of the optical activity material of this information layer and/or a flow, If it irradiates with high energy forcibly in order to become the work which prevents BCA pattern formation on the occasion of BCA pattern formation and to form a BCA pattern, There is no place to absorb shocks, such as boil of optical activity material or evaporation, and A cascade screen and/or exfoliation of an information layer, The droplet of air bubbles, a cave-in, an information layer, and/or cascade screen material occurs in the inside of a BCA pattern, and a periphery, a defect spreads even in the information layer of not only a sub information domain but a main information region, and the generation factor of the fatal defect which becomes unrecordable increases.

[0012]Thus, it is difficult to record at least the BCA pattern which can be detected correctly on a recordable type optical disc, and the problem accompanying formation of a BCA pattern is mentioned to the main factors of the cause which the manufacturing cost of an optical disc goes up.

[0013]This invention aims at offer of the optical disc in which the method and BCA pattern which record BCA stably were formed, to a recording type optical disk.

[0014]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, a record method of an optical recording medium of this invention, Divide a main information region which can record an information signal, and said information signal in the direction of the 1 principal surface of a substrate, and they are provided with a sub information domain which

records auxiliary information from which a kind differs, Read in area of said sub information domain is also equipped with an information layer which records said information signal in said main information region, An optical recording medium which records medium identification information which identifies said medium optically on said information layer of said read in area is used, After scanning an optical beam which lays said a part of spot on top of a vertical scanning direction of a scanning direction of a hoop direction of said spot, and a diameter direction of said spot, irradiating an information layer with a spot of an optical beam and recording said medium identification information on it, An optical beam modulation method of said medium-identification-information record and a different modulation method perform said information signal record.

[0015]After a record method of said optical recording medium performs medium-identification-information record, it is preferred to carry out the phase change of said main information region to a crystallized state succeedingly for initialization.

[0016]As for a record method of said optical recording medium, it is preferred to make it fall rather than optical beam intensity which irradiates said information layers other than said medium identification information with optical beam intensity with which said information layer is irradiated for record of said medium identification information.

[0017]As for a record method of said optical recording medium, it is preferred that a component of said information layer of said main information region and a component of said information layer of said read in area are the same.

[0018]An optical recording medium of a record method of said optical recording medium is a medium of disc shape, and, as for a sub information domain, it is preferred to exist in a position along inner skin of said main information region of said disc shape medium.

[0019]As for a record method of said optical recording medium, it is preferred that read in area exists in the range of not less than 22.3 mm 23.5 mm or less from the center of a disc shape medium.

[0020]A record method of said optical recording medium so that it may leave an amorphous state to stripe shape at read in area or may leave a crystallized state to stripe shape, It is preferred to record on a sub information domain by a postscript region (Burst CuttingArea) which carried out overwrite to said information layer of a pit formation area in said read in area.

[0021]

[Embodiment of the Invention]In order to provide the optical recording medium of this invention with the information layer which can record an information signal over a main information region and a sub information domain and to have the composition which recorded the auxiliary information recorded on the information layer of a sub information domain without changing the shape of an information layer, SUBJECT fatal to the recorded type optical recording medium

that the defect which the information layer of a BCA pattern boundary part cannot recover [of exfoliation or a hole] occurs, originate in the defect concerned, and the information layer of a main information region also becomes unrecordable especially in the case of medium-identification-information pattern formation like a BCA pattern is solvable. What is necessary is to mention optical activity materials, such as coloring matter, a magnetic material, and a phase change material, for example, to choose suitably the energy intensity of light sources, such as a laser beam, and/or a heat source, etc., and just to record them as a gestalt of the information layer of the sub information domain which records auxiliary information without change of shape, corresponding to optical activity material. With the shape change of the information layer as used in the field of this invention, a very minute change of the shape change of the information layer accompanying the shape change of the information layer accompanying the atomic arrangement change between a crystal / crystal, between amorphous and a crystal, etc. and the chemical change of the material which constitutes an information layer, etc. is not included, for example.

[0022]The phase state of the medium identification information which will be recorded, for example on the information layer of a sub information domain if the composition which includes phase change die materials in the information layer of a main information region is adopted, The phase state of the information layer of a main information region can be changed independently, and the phase state of the information layer of each field can be controlled, or the recording part of medium identification information can be recorded with a different phase from the phase state of the information layer of a main information region.

[0023]Since an optical recording medium can be created without changing the material composition of the information layer of a sub information domain, and the information layer of a main information region if the main component material of the information layer of a main information region and the main component material of the information layer of a sub information domain adopt the same composition, an optical recording medium can be provided cheaply.

[0024]If the composition which performs said information signal record process with the optical beam modulation method of said medium-identification-information record process and a different modulation method is adopted after performing said medium-identification-information record process, The portion on which the portion and information signal with which medium identification information is recorded are recorded, or the information signal is recorded with the recording and reproducing device is easily discriminable, and the medium information of a medium information signal part can be recognized exactly.

[0025]If composition including the process of recording an information signal on the information layer of said main information region after said medium-identification-information record process and said phase-number conversion process is adopted, When magneto-optical

recording material or a phase change recording material is included in an information layer, since record, reproduction, and/or elimination are made to the information layer of a main information region, it is desirable. A medium-identification-information record process and a phase-number conversion process may be simultaneously performed so that it may mention later, and they perform the back medium discernment division record process of for example, a phase-number conversion process, or carrying out as a separate process like the reverse order responds at the time of necessity, and it can choose them.

[0026]If the composition which falls rather than the optical beam intensity which irradiates information layers other than medium identification information with the optical beam intensity which irradiates an information layer with medium identification information is adopted, For example, when the material which carries out a phase change between amorphous and a crystal is included in an information layer, It is recordable on an information layer as medium identification information with the state (an amorphous state accounts for the main rate) where membranes were formed, and except a medium-identification-information portion, since phase-number conversion can be carried out to a crystallized state, medium identification information is recordable with the usual initial crystallization device.

[0027]To the scanning direction of the hoop direction of the spot which irradiates an information layer with an optical beam and records medium identification information on it and the vertical scanning direction of the diameter direction of this spot. In order to perform the scan for which a part of spot is piled up, it can respond using light beam spot narrower than the width of the hoop direction of a medium recognition signal, and the length of a diameter direction by the scan to which a spot laps with a scanning direction and a vertical scanning direction.

[0028]If the relative-displacement speed in the scanning direction of a spot and an optical disc is controlled especially properly, it is also possible to make an information layer into an opening like the medium identification information which the information layer of a medium-identification-information portion can be made unevenly distributed with a molten state, and is formed in the reflecting layer in an only for [playback] type optical recording medium. Since this opening-ized medium-identification-information portion is liquefied and an information layer is unevenly distributed, SUBJECT, such as exfoliation etc. of the information layer by the shock which originates in generating of the droplet of the material of an information layer and/or the material of a cascade screen, etc., evaporation, etc. compared with the method of irradiating with the optical beam of the size of a medium-identification-information portion, and creating an opening, and/or a cascade screen, is also cancelable. In order to be dependent on the material of the information layer of an optical disc, and/or the surrounding composition and material of a cascade screen of an information layer, the width of the scanning direction of the optical beam with which a medium-identification-information portion is irradiated, and a vertical

scanning direction, the intensity of an optical beam, and/or the relative velocity of an optical beam and an optical disc are chosen suitably, and are used. Although it also has the effect that the alteration of the medium identification information by a user can be prevented, for example, in the desirable composition which makes a medium-identification-information portion an opening, the shape of the information layer of a medium-identification-information portion of changing with the shape of other information layers is natural in this case.

[0029]If the direction near the back side portion edge side of the hand of cut of the auxiliary information of an optical recording medium adopts composition with much quantity in which the information layer of a sub information domain is unevenly distributed [near the front side edge neighborhood of the auxiliary information of a hand of cut],-izing of the medium-identification-information portion can be carried out [opening], and the same optical property as the medium identification information of an only for [reproduction] type optical recording medium will be obtained.

[0030]In this invention, an optical recording medium is a medium of disc shape, and, as for a sub information domain, it is preferred to make it exist in the position along the inner skin of read in area of said disc shape medium. It is because it is most suitable for said position recording medium identification information.

[0031]In this invention, in an optical disc about 120 mm in diameter, a sub information domain, It is preferred to exist in the range of not less than 22.3 mm 23.5 mm or less from the center of a disk so that an optical pickup may not be mechanistically restricted from a motor and an actuator and main information may not be affected, including the range which can carry out movable [of the optical pickup]. It is because it is most suitable for said position recording medium identification information similarly.

[0032]It is preferred to record auxiliary information by the postscript region (Burst Cutting Area) which carried out overwrite so that it may leave an amorphous state to stripe shape in a sub information domain or may leave a crystallized state to stripe shape. When leaving an amorphous state to stripe shape in a sub information domain, it is preferred to carry out the phase change of the main information region to a crystallized state, and to initialize it succeedingly. When leaving a crystallized state to stripe shape in a sub information domain, the main information region is convenient when using the record film of initialization needlessness (AZUDEPO (as-depo)). It can be made to become amorphous by irradiating with laser power so that it may become an elevated temperature momentarily, although the AZUDEPO film is crystallized from the beginning to such an extent that record film does not break.

[0033]In the above, there are the chalcogenide which uses Te and Se as a base, for example, GeSbTe, GeTe, etc. as record film which carries out the phase change of the main information region to a crystallized state, and initializes it. It can form by the method of for example making

GeSbTe of said chalcogenide depositing slowly, using the gaseous phase thin film depositing methods, such as a vacuum deposition method, as record film of initialization needlessness (AZUDEPO (as-depo)).

[0034]In the above, phase changes are an amorphous state and a crystallized state, and it is preferred that the reflectance of the light of a crystallized state is high not less than 10% as compared with the reflectance of the light of an amorphous state. It is because recorded information can distinguish certainly if reflectance ratios differ 10%.

[0035]When it has disc-like shape, and said optical recording medium irradiates an information layer with the spot of an optical beam and records said medium identification information on it, It is preferred to scan said optical beam which equipped the vertical scanning direction of the scanning direction of the hoop direction of said spot and the diameter direction of said spot with the superposition part which piles up said a part of spot, and to make said superposition part into recorded information. The recorded BCA signal is renewable using the optical beam which can form a BCA signal without a break radially and reproduces main information by this method.

[0036]Hereafter, one example of an invention is described, referring to drawings. Although the following examples explain the case of the rewritten type phase-change optical disk which carries out a phase change reversibly between amorphous and a crystal as an optical recording medium, As an optical recording medium applicable to this invention, it is not limited to a rewritten type phase-change optical disk, and the information layer material of pigment system materials, such as what is called optical magnetic adjusters, such as rare-earth and a transition metal, cyanine dye, and phthalocyanine system coloring matter, etc. in which what is called record is possible can be applied, for example. As phase change die materials, the material which carries out a phase change between amorphous and a crystal or between a crystal / crystal is mentioned, conventionally, since it is a publicly known material, it omits for details, but it is applicable even if it is the material which carries out the phase change also of the material which carries out a phase change reversibly only to one of the two.

[0037](Example 1) Drawing 1 is a block diagram showing an example of the equipment configuration which records medium identification information in an optical disc, and explains the case of BCA as medium identification information. The recorder of the figure, The laser driving part 5 which drives the light source of the optical pickup 4 and the optical pickup 4 which condenses the optical beam generated from light sources made to rotate the optical disc 1, such as the spindle motor 2, the roll control part 3, and a laser beam, and the auxiliary information recorded on an optical disc are modulated. A BCA signal. The BCA signal generating part 6 and BCA signal to create. On a basis, a laser modulation waveform. The waveform set part 7 which operates orthopedically, and the light emitted from the optical pickup 4. The focus control part 8 for condensing on an optical disc, the feed motor 9 to which

the optical pickup 4 is moved and the feed motor control section 10, the position transducer 11 that detects the position of the optical pickup 4, the laser driving part 5, the roll control part 3, the focus control part 8, and the feed motor control section 10. It comprises the system control system 12 controlled synthetically.

[0038]Drawing 2 is an important section section lineblock diagram showing the phase-change optical disk structure of an example of an optical disc applicable to this invention. As shown in drawing 2, in contact with the record film 26 which consists of the dielectric layer 22, the recording layer 23 (what is called an information layer), the dielectric layer 24, and the reflecting layer 25, and the record film 26, ultraviolet curing resin etc. are applied as the resin protective film 27 on one principal surface of the transparent substrate 21. As the recording layer 23, it has the phase change type recording layer, and the phase state of a recording layer can be changed using an optical means, and information storage can be performed. It is pasted together via the glue line 28 by making these two substrates into a couple, and is finished as an optical disc of one sheet. Even if it is the optical disc made symmetrical composition via the glue line 28, of course, it is applicable. The record film 26 in the example shown in drawing 2 to the dielectric layer 22 Zn-SiO_2 (120 nm of thickness), To the recording layer 23, membranes were formed by Zn-SiO_2 (30 nm of thickness) to GeTeSb (20 nm of thickness), and the dielectric layer 24, and the aluminum alloy (90 nm of thickness) was formed by sputtering process at the reflecting layer 25.

[0039]Drawing 3 is a plan of the phase-change optical disk shown in drawing 2. As shown in the figure, the main information record section 31 and the auxiliary information record section 32 exist in the optical disc 1. Main information is record and information played or eliminated in an optical recording and reproducing device, their users are things from which auxiliary information differs for every disk, such as ID (identification information), an encryption key, and a decode key, and it is recorded at the time of optical disc manufacture. Hereafter, the example of this invention explains based on BCA record as auxiliary information record. The pit section which formed the position information about main information, etc. in the sub information domain in the pit in addition to **** is also contained, and, generally BCA is recorded in piles on a part of recording layer of this pit formation area. The auxiliary information record section 32 exists in the range of not less than 22.3 mm 23.5 mm or less from the center of the optical disc 1. This field is also called read in area. In the example shown in drawing 3, the auxiliary information record section 32 is recorded using laser with a wavelength of 810 nm, When the auxiliary information record section 32 was reproduced using laser with a wavelength of 660 nm, the rate of a light reflex of the portion of an amorphous state of the rate of a light reflex of the portion of a crystallized state was 2.5% 16%.

[0040]Drawing 4 shows the flow chart which records BCA on the phase-change optical disk of this invention. The procedure which records BCA is explained using drawing 4. The procedure

which records BCA is roughly divided into three sequences, and consists of the starting sequence 41, the BCA record sequence 42, and the ending sequence 43.

[0041]It rises first and the sequence 41 is explained. At Step 41a, the spindle motor 2 is driven by the roll control part 3 based on the directions from the system control system 12, and the optical disc 1 is rotated at fixed number of rotations (CAV state). At Step 41b, the feed motor 9 controlled by the feed motor control section 10 rotates the screw 13 which supports the optical pickup 4, moves the optical pickup 4 to the diameter direction of the optical disc 1, and is moved to an auxiliary information recording start position. At Step 41c, the laser driving part 5 drives the high output laser 14, such as a semiconductor laser currently used as a light source, based on the directions from the system control system 12. The optical beam emitted from the laser 14 lets the optical system of the optical pickup 4, and the last object lens 15 pass, and is irradiated by the optical disc. The optical power emitted from the laser 14 at this time is an output of the grade which does not crystallize the recording layer 23 of the optical disc 1. Focus control is performed and the optical beam emitted from the laser 14 is made to condense in the shape of [of the optical disc 1] record film at Step 41d. The catoptric light from the optical disc 1 is detected with the photodetector 16, and is outputted as an electrical signal from the photodetector 16. This output signal is amplified by the preamplifier 17, and is inputted into the focus control part 8. According to the input signal from a photodetector, the focus control part 8 drives the voice coil 18 of the optical pickup 4, and it controls it by making the perpendicular direction of an optical disc surface move the object lens 15 slightly so that an optical beam condenses on record film. At Step 41e, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. While detecting that the system control system 12 has an irradiation position of an optical beam in an auxiliary information recording start position based on the acquired position information and outputting an auxiliary information record signal to the waveform set part 7 at Step 41f, the BCA record sequence 42 is started. When there is no irradiation position of an optical beam in an auxiliary information recording start position, the system control system 12 sends a signal to the feed motor control section 10, and the feed motor control section 10 drives the feed motor 9 based on this signal, and makes the optical pickup 4 move slightly, and it moves it to an auxiliary information recording start position. It returns to Step 41e again after this.

[0042]Next, the BCA record sequence 42 is explained. At Step 42a, as shown in drawing 5 (1), the record data (auxiliary information) of the identification information etc. which are recorded on the optical disc 1 is coded, and a BCA pattern (record signal) as shown in drawing 5 (2) is created. In Step 42b, the waveform set part 7 generates a laser modulation waveform based on a BCA pattern. The waveform set part 7 operates orthopedically the laser modulation waveform which reversed the BCA signal sent from the BCA signal generating part 6, and the

BCA signal as indicate the one-revolution pulse signal from the roll control part 3 to be timing to drawing 5 (3) based on the rotational frequency from the system control system 12. The waveform set part 7 outputs a laser modulation waveform, when the auxiliary information record signal from the system control system 12 is received, and when not receiving an auxiliary information record signal, it performs bias outputs, such as a laser output lower than an auxiliary information record signal, for example, a reproducing output etc. While the optical disc 1 rotates one time, Step 42c and Step 42d are performed simultaneously. In Step 42c, BCA record is performed on the optical disc 1. The laser driving part 5 performs laser driving based on the laser output value specified from the system control system 12, and the laser modulation waveform from the waveform set part 7, and a laser beam is outputted like drawing 5 (4). In the optical power in drawing 5 (4), the output 51a is a laser output from which energy required to crystallize the record film 26 of the optical disc 1 is acquired, and the output 51b is an output (for example, reproduction power) of the grade which does not crystallize the record film 26 of the optical disc 1.

[0043]Next, the optical power shown in drawing 5 (4) explains BCA record of a up to [the optical disc 1] using drawing 6. It is condensed on the record film 26 of the optical disc 1, and the optical beam 61 moves relatively by rotating the optical disc 1 in the optical disc 1 top (the arrow of the figure shows the move direction of the optical disc 1). Based on the laser modulation waveform generated by the waveform set part 7, the laser driving part 5 modulates the output intensity of a laser beam. By crystallizing the record film 26, when optical power is 51a, and leaving with the state (mainly amorphous state) where the record film 26 was formed when optical power was 51b, the intermission of the crystallization is carried out and BCA is recorded.

[0044]In Step 42d, while the optical disc 1 makes one revolution, the optical pickup 4 is moved to the diameter direction of the optical disc 1. The procedure which records a BCA pattern is explained using drawing 7, moving an optical pickup. The condensing spot 71 condensed on the record film 26 of the optical disc 1 is carrying out long shape to the diameter direction of the optical disc 1. The movement magnitude 72 of the optical pickup 4 per one spindle motor revolution is the length 71a of the diameter direction of the condensing spot 71, equivalent, or a size below equivalent. With the directions from the system control system 12, the feed motor control section 10 makes the feed motor 9 drive, and it moves the optical pickup 4 so that it may become a fixed speed synchronizing with rotation of the spindle motor 2. By modulating a laser beam on the basis of a one-revolution pulse, as Step 42c described simultaneously, the BCA pattern of stripe shape is formed in the auxiliary information record section of the optical disc 1 from the principle shown by drawing 6.

[0045]At Step 42e, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. While detecting that the system

control system 12 has an irradiation position of an optical beam in an auxiliary information record section based on the acquired position information and outputting an auxiliary information record signal to the waveform set part 7 at Step 42f, it returns to Step 42b. When the irradiation position of an optical beam comes outside an auxiliary information record section, it moves to the ending sequence 43.

[0046]Next, the ending sequence 43 is explained. At Step 43a, the system control system 12 sends a signal to the laser driving part 5, and returns a laser output to reproduction power. At Step 43b, the system control system 12 sends a signal to the focus control part 8, and suspends focus control. At Step 43c, the system control system 12 sends a signal to the laser driving part 5, and makes a laser output zero.

[0047]By the above method, BCA is recordable on the auxiliary information record section of the optical disc 1 shown in drawing 3 by leaving an amorphous state to stripe shape.

[0048]The case where the phase-change optical disk which recorded BCA is played in the usual optical information recording and reproducing device by an above-mentioned method is shown in drawing 5. The BCA pattern recorded on an optical disc at this time is formed in stripe shape like drawing 5 (5). If this stripe is reproduced by the optical head of the usual optical information recording and reproducing device, since reflectance falls compared with a crystallized state, the portion of an amorphous state will be reproduced like drawing 5 (6). This regenerative signal turns into a BCA regenerative signal in the only for [reproduction] type optical recording medium of the conventional example shown by drawing 14 (4), and the almost same regenerative signal. By making a low pass filter pass this regenerative signal, a signal like drawing 5 (7) is acquired and regenerative data like drawing 5 (8) is obtained by carrying out a level slice.

[0049]Although generation of the laser modulation waveform in a waveform set part was based on the one-revolution pulse signal from the spindle motor 2 here, Furthermore, a rotary encoder is provided in the spindle motor 2, and there is a method of setting up the generating timing of an intermittent pulse on the basis of the angle-of-rotation signal of the optical disc 1 detected by this rotary encoder. According to this method, the error of the BCA recording position by the rotational variation of the spindle motor 2, etc. can be reduced, and the accuracy of a BCA recording position can be raised further.

[0050]Although explained in the state of making rotation of the optical disc 1 into the number (CAV) of certain rotations here, There is the method of making rotation of the optical disc 1 a constant linear velocity (CLV) by providing a rotary encoder in the spindle motor 2, and being based on the angle-of-rotation signal of the optical disc 1 detected by this rotary encoder. Since according to this method the laser output for crystallizing record film can be carried out to regularity and the crystallization time difference by linear velocity change is lost, a stable crystallized state can be acquired.

[0051]Although explained using a square wave form like drawing 6 as a laser output for carrying out the intermission of the crystallization here, there is also the method of using a laser output as a multi-pulse shape. According to this method, it is controllable to become the quantity of heat which needs the quantity of heat given to a disc face by a laser beam to crystallize only a crystallization region, and since it can stop that a crystallization region spreads with remaining heat, the optimal BCA recorded state can be acquired.
[0052](Example 2) Drawing 8 is a block diagram showing the composition of the BCA recorder which can also perform initialization processing of an optical disc continuously while recording BCA on the optical disc of this invention. This recorder is adding the change machine 83 which switches each control system according to the BCA record control system 81, the initialization control system 82, and a situation into a system control system to the BCA recorder shown in drawing 1, There is the feature that BCA record and initialization can be performed continuously, to the optical disc 1. The change machine 83 which switches this BCA record and initialization, When the irradiation position of an optical beam is in an auxiliary information record section with the signal from the position transducer 11, system control is carried out according to a BCA record control system, and when it is outside an auxiliary information record section, system control is carried out by an initialization control system.
[0053]Operation with this device concrete using the flow chart of drawing 9 and drawing 10 is shown below about the case where it initializes in the state of CLV, after performing BCA record in the state of CAV as an example. The procedure of this device is roughly divided into four sequences, and consists of the starting sequence 41, the BCA record sequence 42, the initialization sequence 91, and the ending sequence 43. In this example, the radius position 34a in drawing 3, the radius position [in / in auxiliary information recording end position / drawing 3] 34b, the radius position [in / in an initialization starting position / drawing 3] 34b, and initialization end position make an auxiliary information recording start position the radius position 34c in drawing 3.
[0054]It rises first and the sequence 41 is explained. At Step 41a, the spindle motor 2 is driven by the roll control part 3 based on the directions from the system control system 12, and the optical disc 1 is rotated at fixed number of rotations (CAV state). At Step 41b, the feed motor 9 rotates the screw 13 which supports the optical pickup 4, moves the optical pickup 4 to the diameter direction of the optical disc 1, and is moved to an auxiliary information recording start position. At Step 41c, the laser driving part 5 drives the laser 14 based on the directions from the system control system 12. The optical beam emitted from the laser 14 lets the optical system of the optical pickup 4, and the last object lens 15 pass, and is irradiated by the optical disc. The optical power emitted from the laser 14 at this time is an output of the grade which does not crystallize the recording layer 23 of the optical disc 1. Focus control is performed and the optical beam emitted from the laser 14 is made to condense in the shape of [of the optical

disc 1] record film at Step 41d. At Step 41e, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. While detecting that the system control system 12 has an irradiation position of an optical beam in an auxiliary information recording start position based on the acquired position information and outputting an auxiliary information record signal to the waveform set part 7 at Step 41f, the BCA record sequence 42 is started. When there is no irradiation position of an optical beam in an auxiliary information recording start position, the system control system 12 sends a signal to the feed motor control section 10, and the feed motor control section 10 drives the feed motor 9 based on this signal, and makes the optical pickup 4 move slightly, and it moves it to an auxiliary information recording start position. It returns to Step 41e again after this.

[0055]Next, the BCA record sequence 42 is explained. At Step 42a, the record data (auxiliary information) of the identification information etc. which are recorded on the optical disc 1 is coded, and a BCA pattern (record signal) is created. In Step 42b, the waveform set part 7 generates a laser modulation waveform based on a BCA pattern. The waveform set part 7 operates orthopedically the laser modulation waveform which reversed the BCA signal for the one-revolution pulse signal from the roll control part 3 with timing based on the BCA signal sent from the BCA signal generating part 6, and the rotational frequency from the system control system 12. The waveform set part 7 outputs a laser modulation waveform, when the auxiliary information record signal from the system control system 12 is received, and when not receiving an auxiliary information record signal, it performs a bias output. While the optical disc 1 rotates one time, Step 42c and Step 42d are performed simultaneously.

[0056]At Step 42c, BCA record is performed on the optical disc 1. The laser driving part 5 performs laser driving based on the laser output value specified from the system control system 12, and the laser modulation waveform from the waveform set part 7, and a laser beam is outputted like drawing 5 (4). The optical power in drawing 5 (4) is a laser output from which the energy which needs the output 51a to crystallize the record film 26 of the optical disc 1 is acquired, and the output 51b is an output (for example, reproduction power) of the grade which does not crystallize the record film 26 of the optical disc 1. As shown in drawing 6, by irradiating the record film of the optical disc 1 with this modulated optical beam, the intermission of the crystallization is carried out and BCA is recorded.

[0057]In Step 42d, while the optical disc 1 makes one revolution, only a predetermined quantity moves the optical pickup 4 to the diameter direction of the optical disc 1 with constant speed like drawing 7. The BCA pattern of stripe shape is formed in the auxiliary information record section of the optical disc 1 by performing Step 42c and Step 42d simultaneously.

[0058]At Step 42e, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. While detecting that the system control system 12 has an irradiation position of an optical beam in an auxiliary information

record section based on the acquired position information and outputting an auxiliary information record signal to the waveform set part 7 at Step 42f, it returns to Step 42b. When the irradiation position of an optical beam comes outside an auxiliary information record section, it moves to the initialization sequence 91 shown in drawing 10.

[0059]Next, the initialization sequence 91 is explained. If the irradiation position of an optical beam comes outside an auxiliary information record section and it goes into an initialization field, an initialization control system will perform system control with the change machine 83. At Step 91a, the system control system 12 sends a signal to a roll control part, and switches a rolling state to a CLV state from CAV. The system control system 12 sends a signal to the laser driving part 5, and the laser driving part 5 is power required for the record film 26 of the optical disc 1 to crystallize to the set-up linear velocity, and it controls a laser output by Step 91b to become fixed. At Step 91c, while the optical disc 1 makes one revolution, the feed motor control section 10 drives the feed motor 9, and only a predetermined quantity moves an optical pickup. At Step 91d, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. Based on the acquired position information, the system control system 12 detects that the irradiation position of an optical beam is in an initialization field, and returns to Step 91c. When the irradiation position of an optical beam comes outside an initialization field, it moves to the ending sequence 43.

[0060]Next, the ending sequence 43 is explained. At Step 43a, the system control system 12 sends a signal to the laser driving part 5, and returns a laser output to reproduction power. At Step 43b, the system control system 12 sends a signal to the focus control part 8, and suspends focus control. At Step 43c, the system control system 12 sends a signal to the laser driving part 5, and makes a laser output zero.

[0061]By the above operation, after recording BCA by changing the phase state of the record film 26 to the auxiliary information record section on the optical disc 1, initialization processing of the optical disc 1 can also be performed continuously, and a manufacturing process can be simplified.

[0062]In Example 2, after performing BCA record in the state of CAV, the case where it initialized in the state of CLV was explained, but it is also possible to carry out after-initialization BCA record. It is also possible by controlling laser output intensity in accordance with linear velocity to perform BCA record and initialization continuously with a CAV state. It is also possible to perform BCA record and initialization continuously with a CLV state by attaching a rotary encoder to a spindle motor and generating a laser modulation signal on the basis of the angle-of-rotation signal of the optical disc 1 detected by said rotary encoder at the time of BCA record.

[0063](Example 3) By providing the hole (a hole is called below) in which the breakthrough or cave-in which penetrates a recording layer and/or record film is provided using the device

shown by drawing 8 explains how to record a BCA pattern. By irradiating with light spot sufficiently smaller than the BCA pattern formed by this invention compared with the method of recording a BCA pattern by one laser emission to one BCA pattern which is a conventional example over multiple times, Record film and the thermal effect to the periphery, and a thermal damage can be reduced, and a good hole (BCA pattern) can be formed. As shown in drawing 11, it is realizable by raising a laser beam output to the power 111a which film destruction generates at the BCA Records Department. According to this method, initialization processing of an optical disc can also be performed, and a hole can be made in record film as usual, and BCA record can also be carried out.

[0064]Operation with this device concrete using the flow chart of drawing 12 and drawing 13 is shown below about the case where it initializes in the state of CLV, after performing BCA record in the state of CAV as an example. The procedure of this device is roughly divided into four sequences, and consists of the starting sequence 41, the BCA record sequence 121, the initialization sequence 131, and the ending sequence 43. In an auxiliary information recording start position, the radius position 34b of drawing 3 and an initialization starting position are made into the radius position 34a of drawing 3, and initialization end position makes the radius position 34a of drawing 3, and auxiliary information recording end position the radius position 34c of drawing 3.

[0065]It rises first and the sequence 41 is explained. At Step 41a, the spindle motor 2 is driven by the roll control part 3 based on the directions from the system control system 12, and the optical disc 1 is rotated at fixed number of rotations (CAV state). At Step 41b, the feed motor 9 rotates the screw 13 which supports the optical pickup 4, moves the optical pickup 4 to the diameter direction of the optical disc 1, and is moved to an auxiliary information recording start position. At Step 41c, the laser driving part 5 drives the laser 14 based on the directions from the system control system 12. The optical beam emitted from the laser 14 lets the optical system of the optical pickup 4, and the last object lens 15 pass, and is irradiated by the optical disc. The optical power emitted from the laser 14 at this time is an output of the grade which does not crystallize the recording layer 23 of the optical disc 1. Focus control is performed and the optical beam emitted from the laser 14 is made to condense on the record film of the optical disc 1 at Step 41d. At Step 41e, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. While detecting that the system control system 12 has an irradiation position of an optical beam in an auxiliary information recording start position based on the acquired position information and outputting an auxiliary information record signal to the waveform set part 7 at Step 41f, the BCA record sequence 42 is started. When there is no irradiation position of an optical beam in an auxiliary information recording start position, the system control system 12 sends a signal to the feed motor control section 10, and the feed motor control section 10 drives the feed motor

9 based on this signal, and makes the optical pickup 4 move slightly, and it moves it to an auxiliary information recording start position. It returns to Step 41e again after this.

[0066]Next, the BCA record sequence 121 is explained. At Step 121a, the record data (auxiliary information) of the identification information etc. which are recorded on the optical disc 1 is coded, and a BCA pattern (record signal) is created. In Step 121b, the waveform set part 7 generates a laser modulation waveform based on a BCA pattern. The waveform set part 7 operates a laser modulation waveform for the one-revolution pulse signal from the roll control part 3 orthopedically with timing based on the BCA signal sent from the BCA signal generating part 6, and the rotational frequency from the system control system 12. The waveform set part 7 outputs a laser modulation waveform, when the auxiliary information record signal from the system control system 12 is received, and when not receiving an auxiliary information record signal, it performs a bias output. While the optical disc 1 rotates one time, Step 121c and Step 121d are performed simultaneously. In Step 121c, BCA record is performed on the optical disc 1. The laser driving part 5 performs laser driving based on the laser output value specified from the system control system 12, and the laser modulation waveform from the waveform set part 7, and a laser beam is outputted like drawing 11 (1). In the optical power in drawing 11 (1), the output 111a is a laser output from which energy required to destroy the record film 26 of the optical disc 1, and provide a hole is acquired, and the output 111b is an output (for example, reproduction power) of the grade which does not crystallize the record film 26 of the optical disc 1. By irradiating the record film of the optical disc 1 with this modulated optical beam, BCA which carried out the intermission of the hole to a recording layer and/or record film, and equipped them with it is recorded.

[0067]In Step 121d, while the optical disc 1 makes one revolution, only a predetermined quantity moves the optical pickup 4 to the diameter direction of the optical disc 1 with constant speed. The BCA pattern of stripe shape is formed in the auxiliary information record section of the optical disc 1 by performing Step 121c and Step 121d simultaneously. At Step 121e, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. While detecting that the system control system 12 has an irradiation position of an optical beam in an auxiliary information record section based on the acquired position information and outputting an auxiliary information record signal to the waveform set part 7 at Step 121f, it returns to Step 121b. When the irradiation position of an optical beam comes outside an auxiliary information record section, it moves to the initialization sequence 131 shown in drawing 13.

[0068]Next, the initialization sequence 131 is explained. If the irradiation position of an optical beam comes outside an auxiliary information record section, an initialization control system will perform system control with the change machine 83. At Step 131a, the system control system 12 sends a signal to the laser driving part 5, and returns a laser output to reproduction power.

The optical pickup 4 is moved to the diameter direction of the optical disc 1, and it is made to move to an initialization starting position at Step 131b.

[0069]At Step 131c, the system control system 12 sends a signal to a roll control part, and switches a rolling state to a CLV state from CAV. The system control system 12 sends a signal to the laser driving part 5, and controls a laser output by Step 131d to become constant [the laser driving part 5] by power required for the record film 26 of the optical disc 1 to crystallize to the set-up linear velocity. At Step 131e, while the optical disc 1 makes one revolution, the feed motor control section 10 drives the feed motor 9, and only a predetermined quantity moves an optical pickup. At Step 131f, the position transducer 11 detects the position of an optical pickup, and transmits position information to the system control system 12. Based on the acquired position information, the system control system 12 detects that the irradiation position of an optical beam is in an initialization field, and returns to Step 131e. When the irradiation position of an optical beam comes outside an initialization field, it moves to the ending sequence 43.

[0070]Next, the ending sequence 43 is explained. At Step 43a, the system control system 12 sends a signal to the laser driving part 5, and returns a laser output to reproduction power. At Step 43b, the system control system 12 sends a signal to the focus control part 8, and suspends focus control. At Step 43c, the system control system 12 sends a signal to the laser driving part 5, and makes a laser output zero.

[0071]By the above operation, after recording BCA by making a hole in the auxiliary information record section on the optical disc 1 at the record film 26, initialization processing of the optical disc 1 can also be performed continuously, and a manufacturing process can be simplified.

[0072]Although the laser output was made into reproduction power like drawing 11 (1) as a BCA recording waveform here except the BCA Records Department, an initialization starting position is made into the radius position 34b of drawing 3, and there is also the method of making it initialization power except the BCA Records Department like drawing 11 (3). According to this method, since an initialization field becomes narrow, throughput can be raised.

[0073]In Example 3, after performing BCA record in the state of CAV, the case where it initialized in the state of CLV was explained, but it is also possible to carry out after-initialization BCA record. It is also possible by controlling laser output intensity in accordance with linear velocity to perform BCA record and initialization continuously with a CAV state. It is also possible to perform BCA record and initialization continuously with a CLV state by attaching a rotary encoder to a spindle motor and generating a laser modulation signal on the basis of the angle-of-rotation signal of the optical disc 1 detected by said rotary encoder at the time of BCA record.

[0074]There is an effect which can control that a user alters medium identification information freely by establishing a hole in the recording layer and/or record film which were explained in above-mentioned Example 3, and the same medium identification information as an only for [reproduction] type optical recording medium can be formed.
[0075]Although Example 3 explained the case where a hole was established in a recording layer and/or record film to record of medium identification information, this record method is applicable also to the recording layer and/or record film in a main information region. If it applies to a main information region, though it is a rewritten type optical disc, the record method of the optical disc that the alteration of a part of information can be controlled which becomes compatible with rewritable type and the added type of a postscript can be attained.
[0076]If the composition which the linear velocity of the optical disc explained, for example in Example 3 is optimized, and a recording layer and/or record film are liquefied, and is unevenly distributed with surface tension is adopted when a hole is established in a recording layer and/or record film, Although the material of a recording layer and/or record film is unevenly distributed by a hole near the back side edge neighborhood (namely, the record end point side) near the front side edge neighborhood of a hand of cut (namely, the move direction) (namely, the recording start point side), hole parts, Although it becomes the amount of maldistribution near the back side edge neighborhood increases more than the amount of maldistribution near the front side edge neighborhood, and unsymmetrical [the shape of hole parts], since the optical change by hole parts is large, it is fully absorbable. Since hole parts are the maldistribution resulting from the surface tension of the material of a molten state, they can control the impulse force accompanying evaporation of material, etc., and do not have generating of exfoliation of a recording layer and/or record film etc., either.
[0077]Even if the composition of the optical disc applied to this invention is not provided with a reflecting layer, it is completely the same, but. In the case of the optical disc provided with the reflecting layer with the composition which provides especially the breakthrough of Example 3, the composition of a hole penetrated to a reflecting layer is preferred, and, in the case of the medium identification information penetrated to a reflecting layer, the completely same medium identification information as an only for [playback] type optical recording medium is acquired in the case of.
[0078]Although said Examples 1-3 described the record method of fundamental BCA, Example 4 describes the demodulation method at the time of reproduction for the modulating method at the time of record in detail hereafter. Furthermore, the following Example 5 describes the example at the time of applying this BCA, and explains how to prevent the security fall by the alteration assumed by the initializer combination method of BCA.
[0079](Example 4) The modulating method of data is first described in detail using drawing 15 (a).First, in the reed Solomon system error correction code (ECC) adjunct 715, as for the data

which should be recorded, ECC717 is added to the data 716. To 188 bytes of all data 716, Drawing 16 (a) calculates a reed solomon and shows the data configuration which added 16 bytes of ECC717. Drawing 16 (b) shows the data configuration in the case of recording 12 bytes of data 716a. The data volume of the ECC717a section is 16 bytes, and the ECC section and data size in case data is 188 bytes do not change.

[0080]The ECC operation of this invention is not calculated to 12 bytes of the data 716a like usual, when data is 12 bytes, As shown in (b) of Drawing 17, 188 bytes of virtual data configuration 716b which put 0 into 166 bytes to the 3rd line of $RS_{[\text{ which does not exist as substance from the line of the last of } RS_1 \text{ / from } RS_2]\ n}$ is created, an error correction is calculated, and ECC717b is calculated.

[0081]When 8 bits or the 16-bit microcomputer of the small capacity for control of a DVD drive performs the correction operation of BCA, Since each operation program is required, program capacity and memory space may become large and may stop being sufficient in the conventional method which performs a total of 12 kinds of ECC operations including for 44 to [12 bytes, 28 bytes, and] 188 bytes. There is an effect which can carry out ECC processing with the microcomputer of the small capacity of the existing drive by this invention.

[0082](Synchronous code) A synchronous code is described below. Drawing 18 (a) shows the sync bits 719a-719z. Since the interval of the fixed pattern of a synchronized signal is 4T as shown in drawing 18 (b), it becomes easy to distinguish 3T and the alignment pattern of data.

[0083](PE-RZ abnormal conditions) The data 716 containing an ECC code, When recording BCA on the record type media of a type which perform the same groove recordings as DVD-R and a DVD-ROM like DVD-RW, 1 of data and 0 are reversed in the reverse code conversion part 721 of the PE-RZ modulation part 720 for making it distinguish from a ROM disk, and PE-RZ abnormal conditions are carried out by the RZ modulation part 722 and the PE modulation part 723. When it explains using the wave form chart of drawing 20, input data and (1') show bit-flipping data, (2) shows RZ abnormal conditions, and (1) shows a PE-RZ modulating signal (3). A waveform [like drawing 20 (4)] in which this modulating signal is and in which pulse width will be 50% or less in the pulse width reduction-by-half part 724 is acquired.In the case of a phase change type disk like DVD-RW, a waveform is made into an opposite phase by the positive/negative reversal part 725, and as shown in the optical power of (5), only a BCA abnormal-conditions part turns OFF initializing light of the laser 726. Like drawing 20 (6), while a BCA pattern is recorded, the record film between BCA(s) crystallizes and is initialized. Since recording pulse width is narrowed below at half of the original PE-RZ modulating signal in the case of this invention, the width of the stripe of each slot becomes narrow in a half like drawing 20 (6). Since there is only one stripe in two slots, in the BCA field 728, it is accepted in the portion of one fourth of width, i.e., surface ratio, 1/4 in all, and becomes a BCA portion, i.e., low

reflection parts.

[0084]When record film is a phase change material, the reflectance of the bright section which is a portion before record is low before and behind 20%. If the signal of the recording pulse width of the conventional PE-RZ signal is used as it is, as shown in drawing 20 (3), it becomes the dark space which is a portion after a half recording, and since average reflectance becomes 10% order and decreases in average catoptric light, it will have an adverse effect on focusing. In this invention, since pulse width of BCA is made into the half with the pulse width reduction-by-half part 724, even if average reflectance turns into not less than 75% of the reflectance of a portion without original BCA and pit and it uses phase change record film, the average reflectance of not less than 15% is obtained also in a BCA field. For this reason, a focus becomes easy and it is effective in being stabilized.

[0085](When recording on DVD-R) When recording on DVD-R with this recorder, a positive/negative **** control signal is generated and the polarity of the optical power of drawing 20 (5) is reversed by sending to the positive/negative reversal part 725 again. For this reason, the reflectance of the record film of DVD-R of the portion which carried out laser emission falls, and BCA like drawing 20 (6) is recorded. Since there is a function which reverses wave-like polarity, when recording on DVD-R, it is not made reversed, but in recording on DVD-RW, it is effective in the ability to have a function which records BCA on both media as making it reversed by one set. Since drawing 20 has the code pars inflexa 721, with a ROM type disk, 1 of modulation data and the value of 0 are reversed. The modulating signal of a ROM type disk is shown in drawing 19 for comparison. [0086]In drawing 19 and drawing 20, (1) input data is the same. However, since a code inversion signal is not sent in the case of ROM, the code pars inflexa 721 does not operate. For this reason, at the time of "0", a PE-RZ signal is arranged like drawing 19 (3) at a left-hand side slot, and a BCA pattern also serves as left-hand side like drawing 19 (b). On the other hand, a PE-RZ signal is arranged like drawing 20 (3) at a right-hand side slot, and since a code inversion signal is sent in the case of RAM type media, such as DVD-RW and DVD-R, when it is "0", as shown in (c), a BCA pattern serves as right-hand side. Therefore, since the BCA patterns on a disk differ, BCA of BCA and RAM of ROM can be distinguished. Since the patterns of BCA differ even if an inaccurate contractor copies the data of a ROM disk using the RAM disk of DVD-RW or DVD-R, and since it will be distinguished if it is not a ROM disk, it is effective in an unauthorized use being prevented.

[0087]In this invention, the code pars inflexa 721 is turned OFF and BCA can be recorded on a ROM disk like drawing 19 by turning off the positive/negative reversal part 725. In DVD-RW, it is made into ON/ON, and, in the case of DVD-R, turns ON adn OFF, and in the case of DVD-RAM, if OFF/ON is used, regular BCA can record with one recorder. Thus, it is effective in BCA being recordable on DVD-ROM, DVD-R, DVD-RW, and four different media of DVD-RAM

with the same recorder by two switch changes.

[0088](Arrangement of BCA) Arrangement of BCA is shown in drawing 21. In DVD-ROM and DVD-RAM, the BCA field 728 is arranged to a position 23.5 mm in radius from a position with a radius of 22.3 mm of the most inner circumference of read in area. The address 729 is recorded on this field, and since the record angle of a BCA bar code is a maximum of 316 degrees from a minimum of 51 degrees, the non-Records Department exists in the specific angle range of a BCA field. In this free space 730, since an address can be read, the head of playback equipment can know its position. The guard band 731 is in not less than 50 micrometers at the peripheral part of a BCA field, CDC 732 which shows the physical attribute of the disk which is furthermore in a peripheral part is recorded in the pit, and the BCA existence identifier 712, the disk kind identifier 711, the anti-copying identifier 735 that shows an anti-copying disk, and the medium key block 736, i.e., keys, are recorded.

[0089]In DVD-R or DVD-RW, From radius 22.3(22.1)mm at PCA area 737 of the trial writing field for power adjustment, and the range of 22.6(22.4)mm in the range of radius 22.1(21.9)mm to 22.3(22.1)mm of the inner periphery of BCA the history of power control. Not less than 50 micrometers of subguard bands 739 for avoiding interference with the RMA field 738, and the RMA field and the BCA field 728 to record are formed in the inner periphery of BCA. For this reason, the BCA field 728 certainly exists among 22.77 to 23.45 mm correctly for 23.5 mm from 22.8 mm in radius. Thus, by narrowing a BCA field radially compared with ROM, coexistence with PCA and RMA is attained and BCA can be used for DVD-R and DVD-RW. In this case, continuation initialization is begun from an inner periphery at least, and 22.65 mm in radius continues it. And by carrying out intermittent emission based on a PE-RZ modulating signal, recording BCA, and changing to continuation luminescence thoroughly at 23.57 mm in radius, BCA can be recorded by initialization and BCA can be recorded, without making RMA destroy.

[0090](Regeneration method) The regeneration method of BCA is described using drawing 15 (b). First, CDC 732 is accessed by an optical head and it gets over by the 8 -16 demodulation section 738. It stops, when the BCA identifier 712 is read and the BCA identifier judgment part 739 does not show "0", i.e., existence, from CDC to which it restored, When "1", i.e., existence, is shown, the disk kind identifier 711 is read, in the disk kind identifier judgment part 740, only when recording type disks, such as DVD-R and DVD-RW, are shown, the code inversion signal 745 is generated and the code pars inflexa 744 is operated.

[0091]On the other hand, when reproducing BCA data, an optical head is moved to the BCA field 728 shown in drawing 21, a BCA signal is reproduced, it is considered as a digital signal with the level slicer 714, a synchronized signal is extracted in the synchronizing-signal-regeneration part 743, and it restores only to the BCA data 716 by the PE-RZ demodulation section 742. When the above-mentioned code inversion signal 745 is ON, in the code pars inflexa 744, it changes, as shown in (1) from (1') of drawing 20, and 1 and 0 are reversed.

Since the code inversion signal 745 is not generated in the case of a ROM disk, a code is not changed. In this way, the original BCA data is reproduced normally, in the reed-solomon error correction part 746, when BCA is less than 188 bytes like drawing 17 (b), zero data is added, an ECC operation is virtually performed as 188 bytes, an error correction is carried out, and a BCA signal is outputted correctly.

[0092](Example 5)

(Record method of disk ID) Drawing 22 shows the typical manufacturing process of a RAM disk with BCA. First, the encryption key group 700 which contains two or more 1-n-th codes with the code encoder 803 using the 1st encryption key 802, such as a public key and a secret key, is enciphered, and the 1st code and 805 are created. This 1st code 805 is modulated by the eight to 16 modulator 917 of a mastering device, and it is recorded on the 1st record section 919 that has this modulating signal in the inner periphery of the original recording 800 with laser as a concavo-convex pit. As drawing 21 specifically showed, it is recorded on the CDC field 732 with the BCA identifier 711, the disk kind identifier 712, and the anti-copying identifier 735. The disk-like transparent substrate 918 is fabricated with the making machine 808a using this original recording 800, The record film which consists of a phase change type recording material or a charge of a coloring matter raw material with the record film creation machine 808b is formed in one side of the transparent substrate 918, the single-sided disks 809a and 809b of 0.6-mm thickness are created, these two sheets are pasted together, it pastes together by the opportunity 808c, and a completion disk is created. To the 2nd record section 920 of this completion disk 809, with the recorder 807 of BCA. The information on the 2nd encryption key 923 for disk ID921 or Internet communications is modulated with the PE-RZ modulator 807a which combined PE abnormal conditions and RZ abnormal conditions, this modulating signal is recorded by the laser 807b, a BCA pattern is formed, and the recording type disk 801 with BCA is manufactured. In the case of a phase change type recording material, two processes, an initialization process and a BCA record process, can be unified at one process by using the initializer of this invention as a BCA recorder. When this process is described, since record film after forming membranes with the record film creation machine 808b is in an amorphous state or a horse mackerel depository state, its reflectance is as low as 10% or less. When using an initializer, with a boiled-fish-paste lens, a laser beam is radially converged on the beam spot of long stripe shape, image formation is carried out on a recording surface, and a disk is rotated. By making it move to a peripheral part with rotation, and making it irradiate with a beam continuously, record film changes from an amorphous state with low reflectance to a crystallized state with high reflectance, and is continuously initialized from inner circumference on the periphery. By turning off, the signal, i.e., the laser beam, of 0, and turning on in "0 State" in "1 State" of a PE-RZ signal in the 2nd record section, at this time, the signal, i.e., the laser beam, of 1, In the part which turned OFF laser, since an

amorphous state remains, it is still low reflectance, and since it will be in a crystallized state, it becomes high reflectance, and a bar code is formed on the circumference as a result, and BCA is recorded in the turned-on part. If a laser beam goes to the peripheral part of BCA and reaches the inner periphery of the guard band 731 of drawing 21, By making continuously into an ON state the laser which is carrying out interval luminescence according to the BCA signal, from the guard band 731, all the record film of the peripheral part is crystallized that is, initialized, and is initialized to an outermost periphery.

[0093]In DVD-RW, it is shown in drawing 21 -- as -- the inner periphery of BCA, since there are PCA area 737, the RMA field 738, and the guard band 739 up to a field 22.4 mm in radius when the 22.6-mm common difference in radius will be considered from a field 21.9 mm in radius, if the 22.1-mm common difference in radius is considered at least, The first inner periphery carries out continuation luminescence of the laser, and a radius starts the intermittent emission based on a BCA modulating signal in the position between 22.65 to 22.77 mm (for about 22.6-22.8 mm), A BCA pattern is recorded on the BCA field 728, and it changes from intermittent emission to continuation luminescence in the position of a between with a radius [a radius to] of 23.55 mm of 23.45 mm. Since BCA is not recorded on the guard band 731 of drawing 21 by this but PCA area 737 of CDC 732 of the peripheral part of BCA or the inner periphery of BCA and the RMA field 738 are initialized by perimeter completeness by it, It is effective in the ability to read data and an address stably by the optical head of PCA and an RMA field.

[0094]Since the lamination disk is used, BCA included in inside cannot be altered but can be used for a security use. DVD-RAM and the DVD-RW drive which are usually marketed have the circular beam spot. Since an amorphous state remains between tracks even if an inaccurate user is going to alter a BCA portion by the circular beam of this commercial drive and eliminate BCA, BCA is not thoroughly eliminable. Therefore, in a commercial drive, since BCA data cannot be altered, a security effect high as a noncommercial use is acquired.using groove-recordings type RAM disks, such as DVD-RW and DVD-R, on the other hand -- DVD-ROM -- a similar disk may be copied. In order to prevent this, as drawing 20 explained, only the data division of PE-RZ abnormal conditions makes a ROM disk and an abnormal-conditions rule reverse by the inversion part 820b of a code. That is, in the case of RAM, when BCA data is "0" and "1" in the case of ROM, a modulating signal sets to "01" and "10" respectively what was "01" in "10" respectively. Then, since it can distinguish even if it makes the copy disk of ROM using RAM, since the PE-RZ modulating signals of ROM and RAM differ, and injustice can be detected, prevention becomes possible.

[0095](Application to copyright protection) The application which uses BCA with this difficult alteration for copyright protection using drawing 23 is described. When recording first the contents to which the copy was permitted once on a RAM disk, the procedure which uses BCA

and is enciphered is described. When copy permission identifiers are detected once, by accessing the BCA field 920 of RAM disk 856, and carrying out a PE-RZ recovery by the BCA regenerating section 820, the data of BCA is played and ID857 [peculiar to a disk] is outputted. Although the 1-n-th keys 700, i.e., two or more keys, are recorded on the 2nd record section 919 of 856 of the RAM disk, by the key selecting part 703, the key permitted to each manufacturer's drive is selected, it decodes by the code decoder 708, and "the 1st key" is generated. "The 2nd key" is generated by on the other hand calculating ID857 [peculiar to this "1st key" and disk] with a tropism function in the operation part 704. This key changes with each RAM disks, and is peculiar. This the "2nd key" is sent to the encryption section 706 of the encryption section 859. [0096]The contents key 705 is generated by the random number generation part 709 of the contents key generation part 707 in the encryption section 859. This contents key is enciphered in the cryptopart 706 using the above-mentioned "2nd key." This "enciphered contents key" is recorded on the record section 702 of the disk 856 by the record circuit 862.

[0097]On the other hand, using the contents key 705, it is enciphered with the code encoder 861 and the contents 860 which consist of audio signals, such as video signals, such as a movie, and music, etc. are recorded on the record section 702 of RAM disk 856 by the record circuit 862.

[0098]Next, the procedure which reproduces this content signal is explained using the block diagram of drawing 23, and the flow chart figure of drawing 24. First, a disk is inserted (Step 714a) and the reproduction instruction of contents is received (Step 714b), The anti-copying identifier 735 in CDC 732 of a disk is seen, and it judges whether the disk is anti-copying disks, such as CPRM (Step 714c), and if it is not an anti-copying disk, it will play as it is (Step 714d). If it is an anti-copying disk, the BCA identifier 712 in CDC is read at Step 714e. BCA is not reproduced when the BCA identifier 712 (Step 714e) of CDC does not show existence of BCA (Step 714f) (714g of steps). At this time, the information on BCA containing ID857 is played by the PE-RZ demodulation section of the BCA regenerating section 820 from the BCA field of RAM disk 856 (Step 714n). CDC 710 which has recorded the physical attribute of the disk 702 is read (Step 714h), and the disk kind identifier 711 (Step 714h) judges [DVD-ROM, DVD-RAM, and] whether it is either DVD-RW or DVD-R. In the case of DVD-RW or DVD-R (Step 714j), the polarity of the code of data is reversed by the inversion part 820b of the PE-RZ demodulation section 820a (Step 714k). That is, if the reproduced modulating signal is "01", output data is made "0" recoveries "1", if it is "10", and it is made the case of DVD-ROM, and reverse, and gets over (714 m of steps). By the 8 -16 demodulation section 865a of the data reproducing part 865, it restores to main data, and first, the keys 700 which consist of two or more keys from the key block area 919 are reproduced, the key which fitted the device by the key selecting part 703 is chosen, it decodes in the code decoder 708, and "the 1st key" is

reproduced. This ID857 and the above-mentioned "1st key" are calculated in the operation part 704, and "the 2nd key" is generated (Step 714p). So far, it is the same as the recording mode of above-mentioned contents. In the mode which plays enciphered content, it differs in that play and decode "the enciphered contents key" from the disk 856, and the enciphered contents are decoded. In drawing 23, a dotted line shows the flow of only the time of reproduction below, and it is stated to it in detail.

[0099]The "enciphered contents key 713" currently recorded on the record section 702 of the disk 856 is played by the data reproducing part 865, it decodes by the code decoder 714 using the above-mentioned "2nd key", and the contents key 715 is decoded (Step 714q). Using this contents key as a decode key, in the code decoder 863, "the enciphered contents" are decoded (Step 714r) and the plaintext 864 of the m-th contents is outputted (Step 714s). When regularly copied only to the disk of one sheet, one of the enciphered contents keys which were recorded on the RAM disk is this disk ID and a pair, decoding or descrambling of a code is performed correctly and the plaintext 864 of the m-th contents is outputted. In the case of video information, an MPEG signal is elongated and a video signal is obtained.

[0100]In this case, encryption is using disk ID as the key. Since the number of ID is managed and disk ID is manufactured so that only one sheet may exist in a world, the effect that it can copy only to the RAM disk of one sheet is acquired. This principle is expressed below.

[0101]Although forbidden, copying to another RAM disk of one more sheet from the RAM disk copied regularly at the beginning here, When the bit copy of the enciphered contents is carried out as it was at injustice, a number differs between ID1 which is disk ID of the first disk, and ID2 which are disk ID of another RAM disk of one more sheet, i.e., an inaccurate copy disk. Playback of BCA of the RAM disk copied illegally will play ID2. However, since contents or/, and a title key are enciphered by ID1 and keys differ even if it is going to unlock by ID2 in the code decoder 863, neither a title key nor the code of contents is decoded correctly. In this way, the signal of the RAM disk of an illegal copy is not outputted, but it is effective in copyright being protected. Since this invention is Disk ID signalling, even if it plays the regular RAM disk copied only once regularly by which drive, since a code is unlocked, it is effective in convenience being high. However, the lock management center in a remote place may be sufficient as the encryption section 859, and the IC card which carries a code encoder may be sufficient as it, and it may also be included in a recording and reproducing device.

[0102]When BCA is recorded by an initializer, BCA cannot be eliminated in the drive marketed, but the recording disk which does not attach BCA may be obtained and a user may record BCA. the BCA identifier 712 of the disk which does not record BCA since the BCA identifier 712 is recorded on CDC 710 by prepit by this invention as this measure at original recording -- "0" -- it is shown that get blocked and there is nothing and it cannot alter because of prepit. Therefore, since a BCA identifier cannot be altered even if it records BCA on the RAM disk

which this BCA is not recording unjustly later, it is judged that it is inaccurate at the playback equipment side, and it is effective in not operating.

[0103]Although the rewritable phase-change optical disk was taken for the example and the case where the recording layer of a sub information domain and the recording layer of a main information region were the same was moreover explained in the above-mentioned example, . Only the portion which records medium identification information changes the material composition of a recording layer (for example, recording sensitivity is reduced). It is contained in this invention even if it is any that only the portion which records medium identification information makes only a reflecting layer only the portion which changes the material of a recording layer and which records medium identification information (for example, pigment system material is applied) except for a recording layer etc.

[0104]Also except a phase change material, even if it is the composition of using an optical magnetic adjuster, a pigment material, etc. as a material of a recording layer, this invention is applicable.

[0105]

[Effect of the Invention]As mentioned above, according to this invention, medium identification information is stably recordable to an optical recording medium. At the same time as it initializes a phase change type optical recording medium especially, while becoming possible to record medium identification information and being able to attain simplification of a manufacturing process, the advantageous effect that a manufacturing cost can be held down is acquired.

[Translation done.]